COMPAQ
White Paper

January 2000
11N8-0100A-WWEN
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Industry Standard Server Division
Compaq Computer Corporation

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Compaq ProLiant Server NMI Crash Dump Feature

Abstract: This document provides a description of the Compaq ProLiant Class Computer Systems implementation of NMI-based Crash Dump facilities. This facility can be beneficial to system administrators in their root cause failure analysis.

NMI Crash Dump allows customers to obtain critical diagnostic information in the event of system lock-ups and other failures. Both user-initiated and automatic crash dump support is presented.

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White Paper prepared by Industry Standard Server Division

First Edition (January 2000)
Document Number 11N8-0100A-WWEN

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What Is NMI Crash Dump

Non-Maskable Interrupt (NMI) Crash Dump is a diagnostic mechanism. It allows for crash dump files to be created in situations when a system is hung and not able to respond to traditional debug mechanisms.

Crash dump analysis is an essential part of diagnosing reliability problems such as hangs in operating systems, device drivers, and applications. Many crashes will freeze a system in such a way that your only recourse is to do a hard reset-(i.e. power cycle the system). Since resetting the system erases any information that would support an analysis of the problem, it is desirable for the system to be able to perform a memory dump before a hard reset is performed. A dump switch and the associated support in Windows NT, Windows 2000, NetWare, SCO OpenServer 5, and SCO UnixWare 7 provide this function.

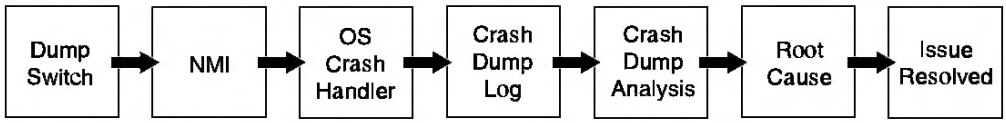

Figure 1: NMI Crash Dump Issue Resolution Events

The dump switch can be used to diagnose software failures by forcing the operating system to invoke the non-maskable interrupt (NMI) handler and generate a crash dump log. The crash dump log can provide critical information for root-cause analysis that may be difficult or impossible to obtain through other means

A user initiates a Non Maskable Interrupt (NMI) event by pressing the dump switch. The NMI can allow a hung system to become responsive enough to generate a crash dump log.

WARNING: Using the NMI Crash Dump switch on a functioning system (using any operating system) will cause the unit to abruptly fail. This is the designed functionality of the NMI Crash Dump Switch. Thus, is should never be used during normal operation.

Compaq has enhanced Automatic Server Recovery (ASR) handling for situations where an automated crash dump may be desired. ASR detects a lockup and normally provides a system reset. ASR can be configured to generate the Crash Dump NMI instead of a reset. This will allow for a crash dump file to be written prior to a system reset.

The Compaq health (systems management) driver must be loaded in order to properly differentiate an NMI caused by the dump switch from a PCI SERR NMI. The dump switch operates even if the health driver is not loaded.

The NMI Crash Dump switch may not work in all situations: after another NMI has already occurred in the system, when the OS crash handler is incapable of running properly, following some hardware failures, and when ASR is in progress, for example.

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Compaq Automatic Server Recovery (ASR)

ASR provides a means to recover from a lockup caused by either the software or the hardware. The feature consists of a hardware countdown timer and a software driver, which periodically refreshes the countdown timer. If the driver fails to report in and refresh the timer, the ASR hardware timer normally resets the machine.

When configured for NMI Crash Dump, in Windows NT 4.0, Windows 2000, SCO OpenServer 5 and SCO UnixWare 7 ASR initiates the NMI Crash Dump instead of resetting the machine

ASR does not cover cases where the operating system or applications may be executing in an indeterminate state. These cases would require the system administrator to intervene and initiate the NMI with the crash dump button.

Note: All Compaq systems require the Compaq health (systems management) driver to support ASR.

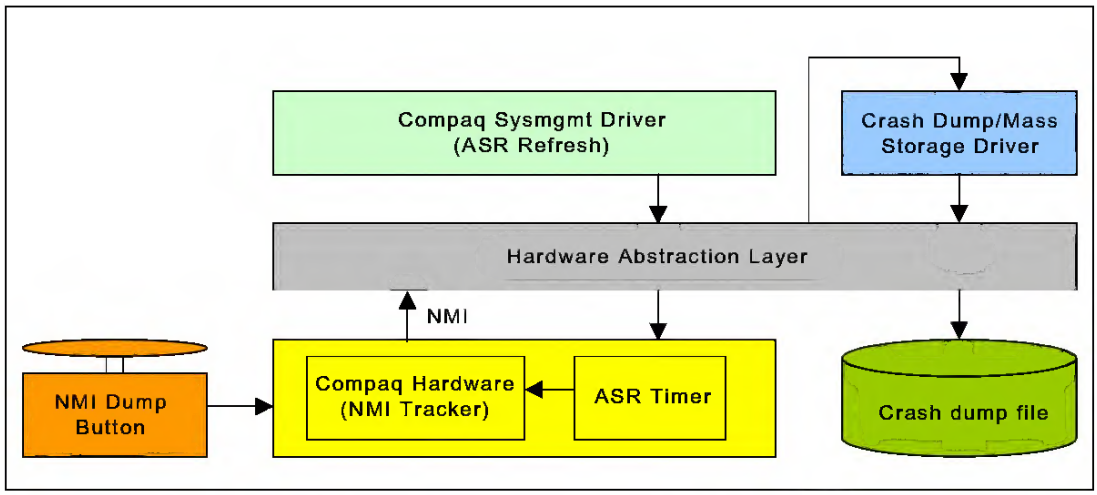

Figure 2: Simplified Block Diagram of NMI Crash Dump Architecture

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Table 1. Highlights and Benefits of the NMI Crash Dump Feature

	NMI Product Highlights	NMI Product Benefits
Microsoft Software	The Microsoft Hardware Abstraction Layer (HAL) is enhanced to support NMI Crash Dump. This enhancement is now standard in the Microsoft HAL delivered with Microsoft NT 4.0 Service Pack 4 or later. No special installation requirements are needed	Allows user level settings for a crash dump file generation to be obeyed.
NetWare	Part of the core operating system. No special installation requirements.	Customer may specify the target file location with NetWare 5. Customer may select to dump all memory or skip the cache memory in NetWare 4 and NetWare 5.
SCO UnixWare 7 SCO OpenServer 5	Part of the core operating system. No special installation requirements unless customer wishes to configure to ASR crash dump file generation.	Allows user level settings for an ASR crash dump file generation.
Compaq Hardware	Push button switch is added to Compaq Servers to create a NMI. Available on the Compaq ProLiant 8000 and 8500.	A push button switch is connected to a Compaq hardware device that causes a NMI (PCI SERR) and initiates the crash dump file creation as described above.
Compaq Software	Components are updated to provide the enhanced ASR NMI functionality to display Integrated Management Log of the events and the new messages for the Integrated Management Display.	This function is dependent upon the Compaq System Management drivers being installed. The device drivers are distributed with the Compaq Windows NT SSD. **Note:** Novell support is on the Novel SSD. UnixWare support is on the EFS.

Note: The push button switch that is connected to the Compaq hardware device is a user-initiated event and may be initiated at any time. This feature does not require any software to generate the NMI.

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Initiating a NMI Crash Dump Under NetWare

1. User presses the NMI Crash Dump push button switch which will present the user with a abend screen.
2. Depending on the version of NetWare, you may see either an ABEND (Abnormal END) screen or a NetWare debugger screen.
   a) From the ABEND screen, press "Y" to create a core dump
   b) From the debugger, type the command ".c" (dot-c) to initiate a core dump
3. Note that the core dump file will be saved on the C: drive (typically C:\COREDUMP.IMG). An adequate amount of free space must be available on the C: drive to store the entire core dump file, which can be as large as the memory installed in the system.
4. Under some circumstances, you may have to force entry into the NetWare debugger. Press shift-alt-shift-esc to enter the debugger, then use the ".c" command to initiate a core dump.

Initiating a NMI Crash Dump Under SCO OpenServer 5 and SCO UnixWare 7

1. User presses the NMI Crash Dump push button switch. The core dump will be written automatically to the swap area. The size and regions of the core dump are determined by operating system specific features. The user should refer to SCO System Administration documentation for information regarding tuning the SCO operation system for generating a core dump.

Note: If the SCO Kernel Debugger is loaded, then the user will be at the SCO Kernel Debugger command prompt when either the button is pressed or the system management (cpqw) driver is configured to generate a crash dump for ASR events. The user can usually just quit the SCO Kernel Debugger to generate a crash dump.

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2. When the systems comes back up, the user is prompted if they want to save the dump to a file. The following information will be required for further analysis of the core dump:
   - The Kernel that was running at the time (/stand/unix)
   - The Crash Dump file
   - For SCO UnixWare 7, the entire contents of the /etc/conf/mod.d directory at the time of the crash should be captured (i.e. a tar file).

Note: Users must save all of the information listed above immediately on the subsequent boot. If not then there may not be enough information available to perform a detailed analysis of the problem. Additionally, if the swap area is smaller than the physical memory installed in the system a selective Crash Dump will be generated. This usually includes kernel memory space.

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3. To enable the automatic generation of a core dump if an ASR event occurs, the Compaq Health (System Management) driver, cpqw, needs to be configured as follows:
   - The Health (System Management) driver from the Compaq Extended Feature Set (EFS) version 5.34 (for Sco OpenServer 5) or version 7.34 (For SCO UnixWare 7) must be installed. A later version is also acceptable.
   - Edit the /etc/conf/pack.d/cpqw/space.c. file and locate the variable: cpqw_ASR_create_crash_dump in this file
   - Change the assigned value from "DISABLED" TO "ENABLED"
   - Relink the UNIX kernel in the usual way and reboot the server to activate the new setting

How to Set Up NMI Crash Dump Under Windows NT 4.0

Microsoft Software

1. User installs Microsoft Windows NT 4.0 with Service Pack 4 or higher.
2. User enables crash dump support through normal Control Panel mechanisms.
3. User enables auto restart support through normal Control Panel mechanisms.
4. User sets the Windows NT registry:

   Enabling NMI Crash Dump:

   HKEY_LOCAL_MACHINE\System\CurrentControlSet\Control\CrashControl\NMICrashDump = (DWORD)1

   Disabling NMI Crash Dump:

   HKEY_LOCAL_MACHINE\System\CurrentControlSet\Control\CrashControl\NMICrashDump = (DWORD)0

WARNING: Before making changes in the Registry, Compaq recommends that you make a copy of the system settings. This will allow you to restore the system setting if there are errors.

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Compaq Software

1. Requires Microsoft Windows NT 4.0 with Service Pack 4.0 or higher.
2. User installs Compaq NT SSD 2.13A or higher.

Note: Nearly all Compaq servers support ASR NMI with the exception of the ProLiant 400 and the ProSignia 720. The ProLiant 8500 is supported by Compaq NT SSD 2.13A available with SmartStart 4.30 or higher. The ProLiant 8000 is supported by Compaq NT SSD 2.14A available with SmartStart 4.40 or higher.

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3. User sets the Windows NT registry:

   Enabling ASR NMI Crash Dump:

   HKEY_LOCAL_MACHINE\System\CurrentControlSet\Services\Sysmgmt\Parameters\FeatureASR = (DWORD)0xe11

   Disabling ASR NMI Crash Dump:

   HKEY_LOCAL_MACHINE\System\CurrentControlSet\Services\Sysmgmt\Parameters\FeatureASR = (DWORD)0

How to Set Up NMI Crash Dump Under Windows 2000

Microsoft Software (subject to change)

1. User installs Microsoft Windows 2000.
2. User enables crash dump support through normal Control Panel mechanisms.
3. User enables auto restart support through normal Control Panel mechanisms.
4. User sets the Windows NT registry:

   Enabling NMI Crash Dump:

   HKEY_LOCAL_MACHINE\System\CurrentControlSet\Control\CrashControl\NMICrashDump = (DWORD)1

   Disabling NMI Crash Dump:

   HKEY_LOCAL_MACHINE\System\CurrentControlSet\Control\CrashControl\NMICrashDump = (DWORD)0

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Compaq Software (subject to change)

1. User installs Compaq NT SSD 5.x (all versions have full support).
2. User sets the Windows NT registry.

   Enabling ASR NMI Crash Dump:

   HKEY_LOCAL_MACHINE\System\CurrentControlSet\Services\cpqasm\Parameters\FeatureASR = (DWORD)0xe11

   HKEY_LOCAL_MACHINE\System\CurrentControlSet\Services\cpqcsm\Parameters\FeatureASR = (DWORD)0xe11

   HKEY_LOCAL_MACHINE\System\CurrentControlSet\Services\cpqss\Parameters\FeatureASR = (DWORD)0xe11

   Disabling ASR NMI Crash Dump:

   HKEY_LOCAL_MACHINE\System\CurrentControlSet\Services\cpqasm\Parameters\FeatureASR = (DWORD)0

   HKEY_LOCAL_MACHINE\System\CurrentControlSet\Services\cpqcsm\Parameters\FeatureASR = (DWORD)0

   HKEY_LOCAL_MACHINE\System\CurrentControlSet\Services\cpqss\Parameters\FeatureASR = (DWORD)0

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Where Is the Crash Dump Button located?

Note: The NMI Crash Dump button hardware will generate a PCI SERR under all Operating Systems. Initiating core memory dumps may be attainable under each individual OS.

ProLiant 8000

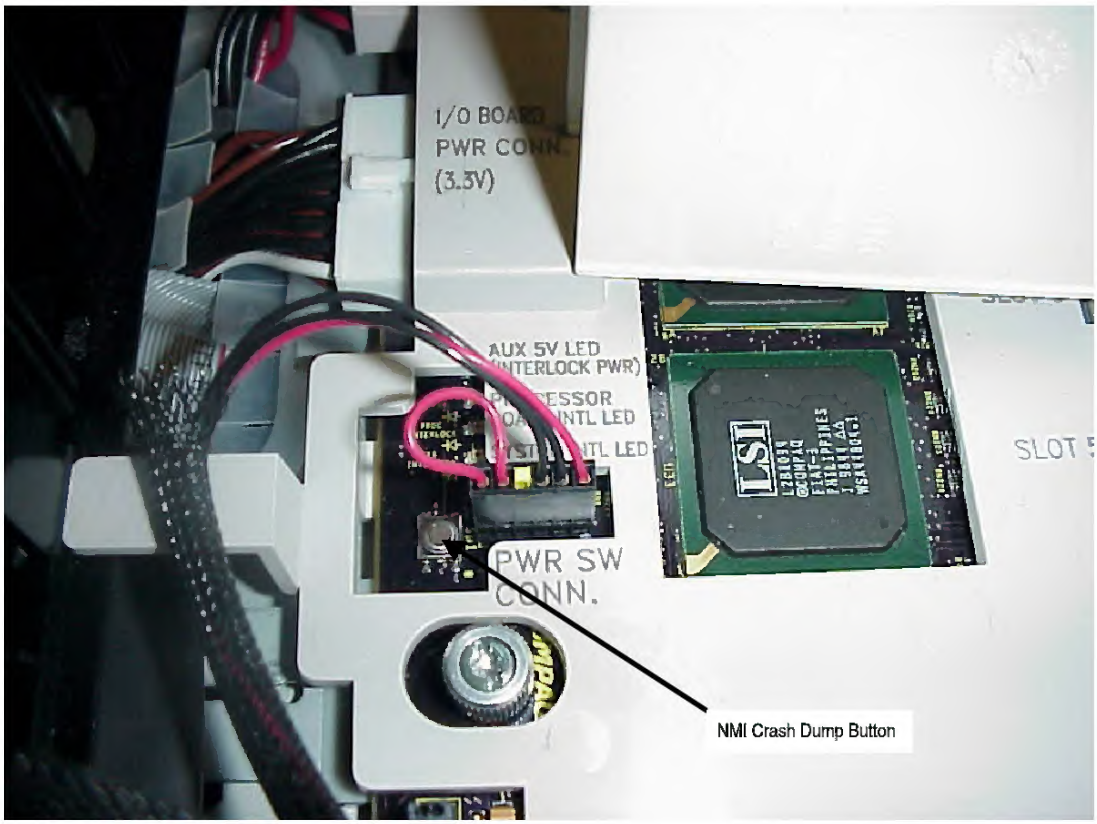

Figure 3: NMI Crash Dump Button Located in the ProLiant 8000 PCI Compartment

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ProLiant 8500

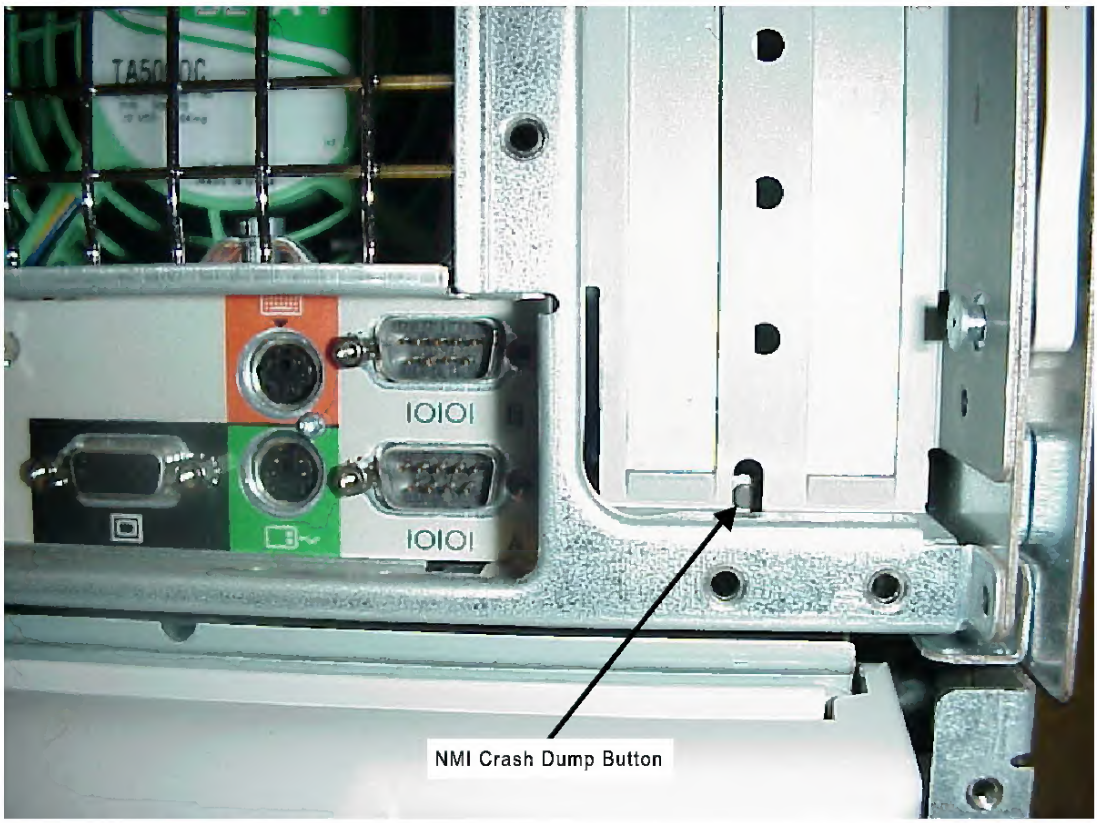

Figure 4: NMI Crash Dump Button Access from the Rear of the ProLiant 8500 Chassis

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